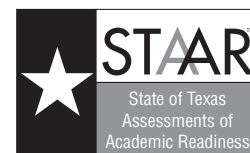


# STAAR PHYSICS REFERENCE MATERIALS



## FORCE AND MOTION

$$\text{Average velocity} = \frac{\text{displacement}}{\text{change in time}}$$

$$v_{\text{avg}} = \frac{\Delta d}{\Delta t}$$

$$\text{Acceleration} = \frac{\text{final velocity} - \text{initial velocity}}{\text{change in time}}$$

$$a = \frac{v_f - v_i}{\Delta t}$$

$$\text{Acceleration} = \frac{(\text{final velocity})^2 - (\text{initial velocity})^2}{2(\text{displacement})}$$

$$a = \frac{v_f^2 - v_i^2}{2\Delta d}$$

$$\text{Displacement} = \left( \text{initial velocity} \right) \left( \text{change in time} \right) + \frac{1}{2} (\text{acceleration}) \left( \text{change in time} \right)^2$$

$$\Delta d = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$\text{Centripetal acceleration} = \frac{(\text{tangential velocity})^2}{\text{radius}}$$

$$a_c = \frac{v_t^2}{r}$$

$$\text{Net force} = (\text{mass})(\text{acceleration})$$

$$F_{\text{net}} = ma$$

$$\text{Work} = (\text{force})(\text{distance})$$

$$W = Fd$$

$$\text{Torque} = (\text{force})(\text{lever arm})$$

$$\tau = Fr$$

$$\text{Power} = \frac{\text{work}}{\text{time}}$$

$$P = \frac{W}{t}$$

$$\text{Pythagorean theorem}$$

$$a^2 + b^2 = c^2$$

## GRAVITATIONAL, ELECTRICAL, AND MAGNETIC FORCES

$$\text{Force of gravitational attraction between 2 objects} = \left( \text{universal gravitation constant} \right) \left( \frac{\left( \text{mass of 1st object} \right) \left( \text{mass of 2nd object} \right)}{\left( \text{distance between centers of objects} \right)^2} \right)$$

$$F_g = G \left( \frac{m_1 m_2}{d^2} \right)$$

$$\text{Force between 2 charged particles} = \left( \text{Coulomb's constant} \right) \left( \frac{\left( \text{charge of 1st particle} \right) \left( \text{charge of 2nd particle} \right)}{\left( \text{distance between particles} \right)^2} \right)$$

$$F_{\text{electric}} = k_c \left( \frac{q_1 q_2}{d^2} \right)$$

$$\text{Electrical power} = (\text{voltage})(\text{current})$$

$$P = VI$$

$$\text{Current} = \frac{\text{voltage}}{\text{resistance}}$$

$$I = \frac{V}{R}$$

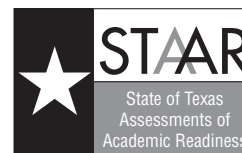
$$\text{Equivalent resistance for resistors in series}$$

$$R = R_1 + R_2 + R_3 + \dots$$

$$\text{Equivalent resistance for resistors in parallel}$$

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

# STAAR PHYSICS REFERENCE MATERIALS



## ENERGY AND MOMENTUM

$$\text{Kinetic energy} = \frac{1}{2}(\text{mass})(\text{velocity})^2$$

$$KE = \frac{1}{2}mv^2$$

$$\text{Gravitational potential energy} = (\text{mass})\left(\begin{array}{c} \text{acceleration} \\ \text{due to gravity} \end{array}\right)(\text{height})$$

$$PE_g = mgh$$

$$\text{Elastic potential energy} = \frac{1}{2}\left(\begin{array}{c} \text{spring} \\ \text{constant} \end{array}\right)\left(\begin{array}{c} \text{distance stretched} \\ \text{or compressed} \end{array}\right)^2$$

$$PE_{\text{elastic}} = \frac{1}{2}kx^2$$

$$\text{Energy} = (\text{power})(\text{time})$$

$$E = Pt$$

$$\text{Work} = \text{change in kinetic energy}$$

$$W = \Delta KE$$

$$\text{Mechanical energy} = \text{kinetic energy} + \text{potential energy}$$

$$ME = KE + PE$$

$$\text{Law of conservation of energy}$$

$$KE_i + PE_i = KE_f + PE_f$$

$$\text{Momentum} = (\text{mass})(\text{velocity})$$

$$p = mv$$

$$\text{Impulse} = (\text{force})(\text{change in time}) = (\text{mass})(\text{change in velocity})$$

$$J = F\Delta t = m\Delta v$$

$$\text{Law of conservation of momentum}$$

$$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$$

$$\text{Heat gained or lost} = (\text{mass})\left(\begin{array}{c} \text{specific} \\ \text{heat} \end{array}\right)\left(\begin{array}{c} \text{change in} \\ \text{temperature} \end{array}\right)$$

$$Q = mc_p\Delta T$$

## WAVES AND LIGHT

$$\text{Velocity} = (\text{frequency})(\text{wavelength})$$

$$v = f\lambda$$

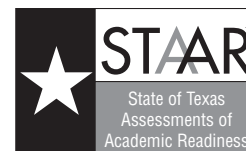
$$\frac{1}{\text{Focal length}} = \frac{1}{\text{distance to image}} + \frac{1}{\text{distance to object}}$$

$$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$$

$$\text{Energy} = (\text{mass})(\text{speed of light})^2$$

$$E = mc^2$$

# STAAR PHYSICS REFERENCE MATERIALS



## CONSTANTS AND CONVERSIONS

$$c = \text{speed of light} = 3.00 \times 10^8 \frac{\text{m}}{\text{s}}$$

$$g = \text{acceleration due to gravity} = 9.8 \frac{\text{m}}{\text{s}^2}$$

$$G = \text{universal gravitation constant} = 6.67 \times 10^{-11} \frac{\text{N} \cdot \text{m}^2}{\text{kg}^2}$$

$$k_C = \text{Coulomb's constant} = 8.99 \times 10^9 \frac{\text{N} \cdot \text{m}^2}{\text{C}^2}$$

$$m_E = \text{mass of Earth} = 5.97 \times 10^{24} \text{ kg}$$

$$r_E = \text{radius of Earth} = 6.37 \times 10^6 \text{ m}$$

$$\text{newton (N)} = \frac{\text{kg} \cdot \text{m}}{\text{s}^2}$$

$$\text{joule (J)} = \text{N} \cdot \text{m}$$

$$\text{watt (W)} = \frac{\text{J}}{\text{s}} = \frac{\text{N} \cdot \text{m}}{\text{s}}$$

$$\text{hertz (Hz)} = \frac{\text{cycle}}{\text{s}}$$

# STAAR PHYSICS REFERENCE MATERIALS



## PERIODIC TABLE OF THE ELEMENTS

1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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1.008 Hydrogen	4.003 Helium	6.941 Lithium	9.012 Beryllium	22.990 Sodium	24.305 Magnesium	39.098 Potassium	40.078 Calcium	44.956 Scandium	47.867 Titanium	50.942 Vanadium	51.996 Chromium	54.938 Manganese	55.845 Iron	58.933 Cobalt	58.933 Nickel	63.546 Copper	65.38 Zinc	69.723 Gallium	72.64 Germanium	74.922 Arsenic	78.96 Selenium	79.904 Bromine	83.798 Krypton	85.468 Rubidium	87.62 Strontium	88.906 Yttrium	91.224 Zirconium	92.906 Niobium	95.96 Molybdenum	101.07 Ruthenium	102.906 Rhodium	106.42 Palladium	107.868 Silver	112.412 Cadmium	114.818 Tin	118.711 Antimony	121.760 Tellurium	126.904 Iodine	131.294 Xenon																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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Mass numbers in parentheses are those of the most stable or most common isotope.

Lanthanide Series

Actinide Series